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(54) **APPARATUS FOR PREVENTING VACUUM COMPRESSION OF SCROLL COMPRESSOR**

VORRICHTUNG ZUR VERHINDERUNG EINER VAKUUMVERDICHTUNG IN EINEM ROLLENVERDICHTER

DISPOSITIF DE PREVENTION DE LA COMPRESSION DU VIDE D'UN COMPRESSEUR A ROULEAU

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- **PATENT ABSTRACTS OF JAPAN vol. 016, no. 083 (M-1216), 28 February 1992 (1992-02-28) -& JP 03 267591 A (SANYO ELECTRIC CO LTD), 28 November 1991 (1991-11-28)**

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Description

[0001] The present invention relates to a scroll compressor, and in particular, to a scroll compressor by which even if the compressor is continuously operated in a state that coolant does not flow into an inlet of a suction tube as the suction tube is clogged, the coolant is partially leaked to a low pressure chamber, so that the inside of the compressor is not reduced to an ultra-vacuum state.

[0002] Generally, compressors in use for air conditioners or refrigerators serves to convert mechanic energy to compression energy of a compressible fluid. Compressors mainly include reciprocating type compressors, scroll type compressors, centrifugal type compressors (normally called turbo type compressors), and vane type compressors (normally called rotary type compressors).

[0003] Among them, the scroll compressors suck and compress gas by using a rotor to discharge it, which is like the centrifugal compressor or the vane compressor. Unlikely, the reciprocating compressors use a linear movement of a piston for the same purpose.

[0004] The scroll compressors include a low pressure scroll compressor or a high pressure scroll compressor depending on whether a suction gas is filled inside a closed container or a discharge gas is filled therein.

[0005] Figure 1 shows a general low pressure scroll compressor in use for air conditioners or refrigerators.

[0006] As shown in the drawing, upper and lower frames 4 and 4' are fixedly installed at the upper and lower portion of the inside of a closed container 3. A suction tube 1 for sucking a coolant gas and a discharge tube 2 for discharging the high pressured coolant gas are respectively installed at one side of the closed container 3.

[0007] A drive motor 17 consisting of a stator 20 and a rotor 18 is fixedly installed between the upper frame 4 and the lower frame 4'.

[0008] A fixing scroll 5 is combined by a bolt 5' at the upper side of the upper frame 4, and an orbiting scroll 6 is rotatably combined with the fixing scroll 5 at the lower side thereof, having a plurality of compressive chambers for compressing coolant sucked from the suction tube 1.

[0009] A wrap W1 is formed in an involute shape at the inner surface of the fixing scroll 5, and an inlet 5a is formed at the outermost side of the wrap W1, communicating with the suction tube 1. An output 5b is formed at the upper side of the central portion of the closed container, communicating with the discharge tube 2.

[0010] A wrap W2 is engaged to be revolved on the inner surface of the orbiting scroll 6 in the fixing scroll 5.

[0011] At the lower side of the orbiting scroll 6, a drive shaft 13 is combined at the central portion of the rotor 18, penetrating the upper frame 4. The drive shaft 13 is provided with an oil passage 13a formed to penetrate the central portion in the lengthy direction and an eccentric portion 13b formed at the upper portion thereof.

[0012] An oil feeder 16 is installed at the lower portion of the drive shaft 13 to pump oil 15 filled at the lower portion inside the closed container 3.

[0013] A slide bush 19 is formed at the eccentric portion 13b of the drive shaft 13, which is varied in the radial direction and receives a rotational force of the drive shaft 13 in the tangential direction. An Oldham's ring 21, a rotation-preventing unit, is combined at the lower portion of the orbiting scroll 6 to prevent the orbiting scroll 6 from rotating.

[0014] A high pressure and low pressure separating plate 8 is fixedly installed at the upper side of the fixing scroll 5 by a plurality of bolts 22. A gas discharge hole 8a is formed at the central portion of the upper side of the fixing scroll 5. The inside of the closed container 3 is divided into a high pressure chamber 10 and a low pressure chamber 14 by the high and low pressure separating plate 8. At one side of the high and low pressure separating plate 8, a back pressure valve 12 is combined to partially discharge the gas of the high pressure chamber 10.

[0015] A discharge chamber 23 is formed at the upper portion of the high and low pressure separating plate 8, communicating with the gas discharge hole 8a and the discharge tube 2. At the side of the discharge hole 8a a bypass hole 25 is formed to be connected with an intermediate pressure chamber 24 formed between the fixing scroll 5 and the orbiting scroll 6. A bypass valve 26 is installed at the upper side of an inlet of the upper portion of the bypass hole 25.

[0016] The operation of the scroll compressor of the convential art constructed as described above will now be explained.

[0017] When the rotor 18 is rotated by an applied current, the drive shaft 13 is rotated as being eccentric as long as the exxentric distance of the eccentric portion 13b according to the rotation of the rotor 18, so that the orbiting scroll 6 is circularly moved.

[0018] Prevented from rotating by the Oldham's ring 21, that is, the rotating-prevention unit, the orbiting scroll 6 makes running movement centering around the drive shaft 13, drawing a turning circle at a distance apart as long as the turning radius. At this time, as the orbiting scroll 6 makes turning movement at the distance apart as long as the turning radius, a plurality of compression chambers 7 are formed between the fixing scroll 5 and the two wraps W1 and W2.

[0019] Accordingly, a coolant gas filled in the compression chambers 7 by being sucked through the inlet 5a placed at one side of the fixing scroll 5 is moved toward the center of the scrolls 5 and 6 by the continuous turning movement of the scrolls 5 and 6. While being moved, its volume is reduced to be compressed, discharged through the outlet 5b of the fixing scroll 5, and passed through the high and low pressure separating plate 8 to flow into the high pressure chamber

10. And this coolant gas flown into the high pressure chamber 14 is introduced to a condensor (not shown) through the discharge tube 2.

[0020] At this time, in case that the pressure of the coolant being discharged to the high pressure chamber 10 is too high, the back pressure valve 12 is forced to open so as to discharge a portion of the coolant to the low pressure chamber 14, so that an abnormal over-compression can be prevented from occurring.

[0021] In addition, when the drive shaft 13 is rotated, the oil 15 is pumped by the oil feeder installed at the lower end portion of the drive shaft 13 and supplied upwardly through the oil passage 13a, so that friction resistance of a thrust face 4a of the upper frame 4 that contacts the orbiting scroll 6 is reduced.

[0022] However, the scroll compressor of the conventional art has the following problem. That is, in the abnormal pressure condition due to over-compression, the gas can be moved by the back pressure valve. But, in case that a pipe line through which the coolant is circulated is partially clogged and thus the coolant is prevented from sucking to the sucking tube, though the compression is continuously made in the compressive chamber, the pressure of the high pressure chamber does not go beyond a pre-set pressure at which the back pressure valve is operated. Consequently, the inside of the compressor becomes a vacuum state, and if this vacuum state is maintained for a certain time, the inside of the compressor becomes ultra-vacuum state causing a short in a charging portion of the drive motor due to degradation of electric insulation, resulting in a high possibility that the drive motor is damaged and an electric shock occurs due to a leakage current.

[0023] In addition, since oil is not sufficiently supplied to the thrust face of the upper frame contacting the orbiting scroll at the initial state of driving the compressor the contacting portion is easily abraded.

[0024] Figure 2 shows another example of a scroll compressor in accordance with a conventional art.

[0025] In describing the scroll compressor, the same reference numerals are given for the same elements as in Figure 1, for which descriptions are omitted.

[0026] As shown in the drawing, a valve stopper 3a is combined at the central portion of the upper surface of the fixing scroll 5, communicating with an outlet 5b of the fixing scroll 5. A check valve 30 is installed inside the valve stopper 3a to control flowing of the coolant gas of high temperature and high pressure as compressed in the compression chamber 7, for which the check valve 30 is moved upwardly and downwardly along a guide face 'G' of the inner side of the valve stopper 3a to open and close the outlet 5b of the fixing scroll 5.

[0027] A discharge hole 3a' is formed at the upper surface of the valve stopper 3a.

[0028] The operation of another example of the scroll compressor of the conventional art constructed as described above will now be explained.

[0029] According to the scroll compressor of the another example, in case that the scroll compressor stops operating for a short time and starts operating, the check valve 30 serves in a manner that the gas of the high pressure chamber 10 flows back to be introduced into the compression chamber 7 formed by the wraps W1 and W2 of the fixing scroll 5 and the orbiting scroll 6 through the outlet 5b of the fixing scroll 5, to thereby reversely rotate the orbiting scroll 6, so that the wraps W1 and W2 can be prevented

[0030] from damaging and a noise does not occur. Besides, in order to prevent a degradation of the compression efficiency, the check valve 30 clogs the outlet 5b to thereby prevent the orbiting scroll 6 from reversely rotating against reverse discharging.

[0031] Meanwhile, the coolant gas compressed in the compression chamber 7 pushes up the check valve 30 placed at the front end through the outlet 5b of the fixing scroll 5, so as to be discharged. At this time, the check valve is moved along the inner wall of the valve stopper 3a to start a stroke, and as the compressor is continuously being operated, the check valve is placed in a raised position, maintaining contacting the face of the upper end portion of the valve stopper 3a.

[0032] Since the check valve 30 is placed in the raised position while the compressor is operated, the compressed coolant gas is discharged through the discharge hole 3a' of the valve stopper 3a. When the compressor stops operating, the discharge gas filled in the upper portion of the closed container 3 applies a force to the upper surface of the check valve 30 through the discharge hole 3a' of the valve stopper 3a, then, the check valve 30 rapidly closes the discharge hole 5b of the fixing scroll 5, thereby preventing the discharge gas from flowing back.

[0033] However, disadvantageously, the scroll compressor according to the second conventional art has a structure that in case that the compressor keeps operating in a state that the coolant does not flow into the inlet, the high-pressured discharge gas won't be bypassed toward the low pressure side, for which there is no device or structure provided in preparation for occurrence of vacuum at the suction side possibly caused when a cooling cycle is interrupted.

[0034] Accordingly, for the products adopting the scroll compressor, a service valve (not shown) is installed to connect an indoor device and an outdoor device. In this respect, if the scroll compressor is started in a state that the service valve is locked up, the coolant gas being introduced to the low pressure side gradually dies away, pushing into a high vacuum state, resulting in that a drive motor is exposed in the high vacuum, so as to be damaged due to the vacuum discharge, the temperature of the discharge gas goes up due to the high compression ratio, and the compression unit is abraded due to shortage in supply of oil.

[0035] In addition, if such abnormal operation of the compressor is continued for a long time, vacuum of the low pressure chamber and the compression chamber, that is, the suction pressure region, is accelerated, resulting in that a hermetic terminal (not shown) is damaged due to the vacuum compression or tip-sealing is degraded due to the re-compression by the compression unit to be broken down. Thus, reliability of the compressor is inevitably degraded.

[0036] Examples of other prior art scroll compressors are disclosed by US-A-5090880 and US-A-51 69294.

[0037] In the scroll compressor disclosed by US-A-5090880 a check valve operates by the difference between the discharge pressure of a high pressure space and the suction pressure of a lower pressure space,

[0038] The scroll compressor disclosed by US-A-51 69294 aims to prevent an over compression in the compression chamber.

[0039] A further prior art scroll compressor (US-A-5803716) comprises a dumping valve in a passageway for connecting the discharge side of the compressor to the suction side thereof in order to prevent reverse rotation of the orbiting scroll. The dumping valve is opened by means of a solenoid when the pressure in an intermediate pressure chamber equals the suction pressure. The dumping valve is controlled by the pressure in an intermediary pressure chamber connected to an intermediary pressure section of the scroll compressor. The valve member is provided with biasing coil springs for controlling the rate of opening of the dumping valve. This is a relatively complicated configuration.

[0040] Thus, in order to overcome the above problems, an object of the present invention is to provide an apparatus for preventing vacuum compression of a scroll compressor which is capable of preventing the inside of a compressor from being an ultra vacuum state when a pipe line is clogged, so that its drive motor can be prevented from breaking down, the temperature of a discharge gas due to a high compression ratio can be prevented from increasing, and a compressive unit can be protected by being successively supplied with oil.

[0041] Another object of the present invention is to provide an apparatus for preventing vacuum compression of a scroll compressor which is capable of preventing a vacuum compression of a compressor by using an intermediate pressure.

[0042] Still another object of the present invention is to provide an apparatus for preventing vacuum generation of a scroll compressor which is capable of preventing the inside of the compressor from becoming a vacuum state as well as preventing a thrust face from abrading.

[0043] Also, the object of the invention is to minimize in an uncomplicated manner the influence of the discharge pressure on the valve member of a high vacuum provided in a scroll compressor.

[0044] These objects are achieved in accordance with the present invention by a scroll compressor comprising the features of claim 1 . Improvements and further features of the invention are subject matter of the claims dependent from claim 1.

[0045] In order to achieve the above objects, there is provided an apparatus for preventing vacuum compression of a scroll compressor including: a suction tube and a discharge tube each combined to one side of a closed container filled with oil to an adequate height; a fixing scroll having a wrap and a coolant inlet and an outlet; a high and low pressure separating plate installed at the upper side of the fixing scroll, dividing the inside of the closed container into a high pressure chamber and a low pressure chamber, the high and low pressure separating plate having a gas discharge hole at its central portion; an orbiting scroll having a plurality of compressive chambers for compressing a sucked coolant by being rotatably engaged with the wrap of
the fixing scroll at the lower side of the fixing scroll, and having a wrap for rendering each compression chamber to have different pressure to be successively moved as being turned; and a high vacuum preventing unit installed at the inner side of the body of the fixing scroll.

[0046] In order to achieve the above objects, there is also provided an apparatus for preventing vacuum compression of a scroll compression in which the fixing scroll and the orbiting scroll are rotated in the compressive chamber to compress a coolant and oil supplied through an oil passage is supplied to a thrust face of an upper frame of the scroll compressor as a drive shaft is being rotated, including a back pressure line formed at the orbiting scroll so that a compression chamber can communicate with the thrust face to discharge a portion of the coolant gas compressed in the compression chamber of the scroll compressor to the low pressure chamber.

[0047] In order to achieve the above objects, there is also provided an apparatus for preventing vacuum generation of a scroll compressor in which a valve stopper is combined to the upper portion of a discharge hole formed at the fixing scroll, a check valve is installed in the scroll compressor to be moved upwardly and downwardly along a guide face of the inside of the valve stopper to control flowing of the coolant gas of high pressure and high temperature compressed in the compressive chamber, to open and close the discharge hole of the fixing scroll, including: a mutually communicating by-pass hole for by-passing a high pressured coolant gas to a low pressure side at the time when the check valve closes the discharge hole of the fixing scroll.

[0048] A preferred embodiment of the invention and its mode of operation are described below referring to the drawings, wherein

Figure 1 is a vertical-sectional view showing one example of a scroll compressor in accordance with a conventional art;
Figure 2 is a vertical-sectional view showing another example of a scroll compressor in accordance with a conven-

tional art;

Figure 3 is a vertical-sectional view showing an apparatus for preventing vacuum compression of a scroll compressor in accordance with an embodiment of the present invention;

Figure 4 is a detailed sectional view of the portion 'IV' of Figure 3 in accordance with the embodiment of the present invention;

Figure 5A is a sectional view showing an operation in case that the apparatus for preventing vacuum compression of a scroll compressor is normally performed in accordance with the embodiment of the present invention;

Figure 5B is a sectional view showing an operation when the apparatus for preventing vacuum compression of a scroll compressor is performed in vacuum in accordance with the embodiment of the present invention;

Figure 6 is a sectional view of a modified apparatus for preventing vacuum compression of a scroll compressor in accordance with the embodiment of the present invention;

Figure 7A is a view showing a normal operation of the modified apparatus for preventing vacuum compression of a scroll compressor of Figure 6 in accordance with the embodiment of the present invention;

Figure 7B is a view showing an operation in a vacuum compression of Figure 6 in accordance with the present invention; and

Figure 8 is a graph showing a pressure line of a compressor adopting the apparatus for preventing vacuum compression of a scroll compressor in accordance with the embodiment of the present invention.

[0049] The apparatus for preventing vacuum compression of a scroll compressor in accordance with an embodiment of the present invention will now be described with reference to the accompanying drawings.

[0050] The same elements as in Figure 1 of the conventional art will be given the same reference numerals, description for which are omitted.

[0051] As shown in Figures 3 through 5B, the apparatus for preventing vacuum compression of a scroll compressor in accordance with an embodiment of the present invention is constructed as follows. A cylinder 120 is formed at the inner side of the fixing scroll 5 in the vertical direction.

[0052] A balance mass 121 is slidably installed inside the cylinder 120, and a coolant flow groove 121 a is formed at a predetermined portion of the outer circumferential surface of the balance mass 121. An intermediate pressure hole 122 is formed at the lower side of the balance mass, to connect the bottom surface of the cylinder 120 and a bypass hole 25.

[0053] A high pressure connection hole 123 and a low pressure connection hole 124 are respectively formed at both sides of the balance mass 121. The high pressure connection hole 123 renders the cylinder 120 to communicate with a high pressure chamber 10, and the low pressure chamber connection hole 124 renders the cylinder 120 to communicate with a low pressure chamber 14. A communicating portion 125 is formed at one side of the upper portion of the balance mass 121, rendering the upper end portion of the cylinder 120 to communicate with the low pressure chamber 14.

[0054] The coolant flow groove 121 a is formed at a predetermined portion of the balance mass 121 at the same height of both of the high pressure chamber connection hole 123 and the low pressure chamber connection hole 124 from the bottom of the cylinder 120, so that when the balance mass 121 is positioned at the lower portion inside the cylinder 120, the coolant of the high pressure chamber 10 can flow into the low pressure chamber 14 through the coolant flow groove 121a.

[0055] The operation of the apparatus for preventing vacuum compression of a scroll compressor in accordance with the present invention constructed as described above will now be explained.

[0056] When power is supplied and a rotor 18 of a drive motor 17 is rotated, a drive shaft 13 fixed at the rotor 18 is rotated, according to which the orbiting scroll 6 combined to the eccentric portion 13b of the drive shaft 13 is rotated. As the orbiting scroll 6 is rotated, the coolant gas sucked into the compressive chamber 7 through the suction tube 1 is compressed in the compressive chamber 7 that is formed when the fixing scroll 5 and the orbiting scroll 6 are rotated. The compressed coolant gas of high pressure is discharged to the discharge chamber 23 through the outlet 5b and sent to the condenser through the discharge tube 2 connectedly installed at the discharge chamber 23.

[0057] In the above normal operation, since the balance mass 121 is moved upwardly within the cylinder 120 by the coolant gas pressure of the intermediate pressure hole 122, coolant movement from the high pressure chamber 10 to the low pressure chamber 14 does not occur.

[0058] That is, according to the position of the balance mass 121 within the cylinder 120, the coolant may flow from the high pressure chamber 10 to the low pressure chamber 14 or not. The balance mass 121 is mainly influenced by the intermediate pressure of the coolant flown into the intermediate pressure hole 122 and the suction pressure working at the upper side of the balance mass 121 through the communicating portion 125.

[0059] The operation of the balance mass 121 will now be described in detail.

[0060] Assuming that the force working on the balance mass 121 is 'F', the intermediate pressure is 'Pm1', the suction pressure is 'Ps1', the balance weight is 'M', the force pushing the balance mass through the intermediate pressure hole is 'Fm', the force pushing down the balance mass by the suction pressure is 'Fs', the self weight of the balance mass is 'Fb(M)', the discharge pressure is 'Pd1, the diameter of the balance mass is 'D', and the friction force is 'μ', the following formulas are obtained.

$$F = Pm1 - Ps1 - M$$

$$F = Fm - Fs - Fb - (\mu\ Pd1 \times area)$$

$$Fm = Pm1 \times \pi D^2/4$$

$$Fs = Ps1 \times \pi D^2/r$$

$$F = (Pm1 - Ps1) \times \pi D^2/4 - M - \mu Pd1$$

[0061] For example,
D = 0.03m, M = 1kgf, Pm1 = 15 kgf/cm^2, Ps1 = 5 kgf/cm^2, Fu = μPd1 x area

$$F = (15 - 5) \times 1002 \times \pi 0.03^2/4 - 1 - F\mu$$

[0062] In case where F = 69.7 kgf - Fμ > 0, the balance mass 121 is attached at the upper portion inside the cylinder 120, as shown in Figure 5B, and the coolant is blocked from flowing from the high pressure chamber 10 to the low pressure chamber 14.

[0063] That is, during the normal operation as shown by the pressure line in Figure 8, the balance mass is pushed up by the compressed intermediate pressure (Pm1), so that there is no need to flow the coolant from the high pressure chamber 10 to the low pressure chamber 14.

[0064] However, in case that a portion of the pipe line is clogged and thus the compressive chamber 7 is vacuumized, assuming that the intermediate pressure is 'Pm2' and suction pressure is 'Ps2, since the intermediate pressure and the suction pressure are similar to each other as shown in the graph of Figure 8, $Pm^2 - Ps^2 = 0$ kgf/cm^2,

[0065] Accordingly, since -1kgf + Fμ < 0, the balance mass 121 dropped down to the low side of the cylinder 120, as shown in Figure 5, due to the self weight of the balance mass 121, so that the coolant of the high pressure chamber 10 is bypassed to the low pressure chamber through the coolant flow groove 121 a of the balance mass 121.

[0066] Therefore, the coolant that was bypassed toward the low pressure chamber 14 is compressed again in the compressive chamber 7, thereby preventing the ultra vacuum state.

[0067] As shown in Figure 6, the basic structure of this apparatus is the same as that of Figure 4 except a spring 130 installed at the upper portion within the cylinder 120 to elastically support the balance mass 121 downwardly, so that when the balance mass 121 is to be moved downwardly, the spring 130 pushes it regularly.

[0068] In case of the installation of the spring 130, assuming that force of the spring is 'Fk',

$$F = Pm1 - Ps1 - M - Fk$$

$$F = Fm - Fs - Fb - Fk - (\mu Pd1 \times area)$$

$$Fm = Pm1 \times \pi D^2/4$$

$$Fs = Ps1 \times \pi D^2/4$$

$$Fk = k \times m^2 \ (m^2\text{: displacement m})$$

$$F = (Pm1 - Ps1) \times \pi D^2/4 - M - km^2 - \mu Pd1$$

[0069] For example,
$D = 0.03m$, $M = 1$ kgf, $k \times m^2 = 2$ kgf, $Pm1 = 15$ kgf/cm^2, $Ps1 = 5$ kgf/cm^2

$$F\mu = \mu Pd1 \times \text{area}$$

$$F = (15\text{-}5) \times 1002 \times \pi 0.03^2/4 - \text{l} - 2 - F\mu$$

[0070] In case that $F = 67.7$ kgf - $F\mu > 0$, it signifies the normal operation that the pipe line is not clogged. In this state, as shown in Figure 7B, the balance mass 121 is attached to the upper portion, overcoming the force pushed by the spring 130 inside the cylinder 120, and the coolant is blocked from flowing from the high pressure chamber 10 to the low pressure chamber 14.

[0071] That is, as shown Figure 8 illustrating a graph of the pressure line, in the normal operation, since the balance mass 121 is pushed up by the intermediate pressure Pm1, the coolant of the high pressure chamber 10 does not need to be flown to the low pressure chamber 14.

[0072] Meanwhile, in case that a portion of the pipe line is clogged and thus the compressive chamber 7 is vacuumized, since the intermediate pressure and the suction pressure are similar to each other as shown in the graph of Figure 8, $Pm^2 - Ps^2 = 0$ kgf/cm^2. Thus, -3 kgf + $F\mu < 0$, so that the balance mass 121 is moved downwardly in the cylinder 120 as shown in Figure 7A due to the self weight and the force pushed by the spring 130. Then, the coolant of the high pressure chamber 10 is bypassed toward the low pressure chamber 14 through the coolant flow groove 121 a of the balance mass 121, and the coolant bypassed to the low pressure chamber 14 is compressed again in the compressive chamber 7, thereby preventing ultra vacuum state from occurring.

[0073] Accordingly, by adjustably dropping down the balance mass 121 in the cylinder 120 by adjusting the weight of the balance mass 121 or controlling the elastic modulus of the spring 130, even through the pipe line is clogged, the compressor is prevented from being an ultra vacuum state at a proper time, so that the equipment can be prevented from sudden-downing.

[0074] As described above, the compressive chamber as well as the low pressure chamber of the closed container is prevented from a vacuum state, so that hermetic terminal is prevented from damaging possibly caused due to the vacuum state. In addition, parts is prevented from degrading caused when the compression mechanism unit is re-compressed, and thus, reliability of the compressor is improved.

INDUSTRIAL APPLICABILITY

[0075] As so far described, according to the apparatus for preventing vacuum compression of a scroll compressor of the present invention, the inside of the compressor is prevented from being an ultra vacuum state by moving the coolant of the high pressure chamber to the low pressure chamber of the inlet, so that a motor is protected from breaking down due to a short that may occur in case that the inside of the compressor becomes an ultra vacuum state and an incident due to a leakage current can be prevented.

[0076] In addition, according to the apparatus for preventing vacuum compression of a scroll compressor, since oil included in the coolant gas leaked through the back pressure line is reserved at the lower storage recess, the trust face of the upper frame is sufficiently lubricated, so that parts can be prevented from abrading.

[0077] Moreover, according to the apparatus for preventing vacuum compression of a scroll compressor, damage of the hermetic terminal due to a vacuum compressor occurring as the low pressure chamber is vacuumized can be prevented. And, parts are prevented from degrading caused when the compression mechanism unit is re-compressed, and thus, reliability of the compressor is improved.

Claims

1. Scroll compressor, comprising :

a suction tube (1) and a discharge tube (2) each combined to one side of a closed container (3) filled with oil (15) to an adequate height;
a fixed scroll (5) having a wrap (W1) and a coolant inlet (5) and an outlet (5b) for compressed coolant ;
a high and low pressure separating plate (8) installed at the upper side of the fixed scroll dividing the interior of the closed container into a high pressure chamber (10) and a low pressure chamber (14), the high and low pressure separating plate having a gas discharge hole (8a) ;
an orbiting scroll (6) having an orbiting wrap (W2) rotatably engaged with the wrap of the fixed scroll at the lower side of the fixed scroll for rendering of a plurality of intermediate compression chambers (7; 24) to have different pressure when successively moved by turning the orbiting scroll, and
a vacuum preventing valve unit within the closed container of the scroll compressor,
characterized in that
for preventing high vaccum within the closed container (3) a cylinder (120) is formed in vertical direction inside the body of the fixed scroll (5) between the high pressure chamber (10) and the low pressure chamber (14) which cylinder communicates with the intermediate compression chambers (7; 24) in which the coolant is compressed, a valve member (121) having for interconnecting the discharge and the suction pressure compartments a coolant flow groove (121a) on its outer circumferential surface being slidably inserted into the cylinder and moveable according to pressure variations of the intermediate compression chambers (7; 24) depending on the operational state of the compressor to communicate or block the low pressure chamber and the high pressure chamber to each other, respectively, and an elastic member (130) being inserted between the valve member (121) and the valve housing to support the valve member and to reinforce the motion of the valve member.

2. Compressor according to claim 1, **characterized in that** the valve housing is divided into a suction pressure space and an intermediate pressure space (24) by the valve member (121) to have a valve drift space in the vertical direction, in which a suction pressure-sided gas hole is formed at the suction pressure space to be opened and closed by the valve member to communicate with the low pressure chamber (14), an intermediate pressure-sided gas hole (122) is formed at the intermediate pressure space to communicate with the intermediate compression chamber, and a discharge pressure-sided gas hole is formed at the circumferential surface to be opened and closed by the valve member along with the suction pressure-sided gas hole to communicate with the high pressure chamber (10).

3. Compressor according to claims 1 or 2, **characterized in that** the elastic member (130) is inserted in the suction pressure space of the valve housing.

Patentansprüche

1. Rollenverdichter mit:

einem Ansaugrohr (1) und einem Auslassrohr (2), welche jeweils an einer Seite eines geschlossenen Behälters (3), der bis zu einer adäquaten Höhe mit Öl (15) gefüllt ist, angebracht sind;
einer fixierten Rolle (5) mit einer Hülle (W1) und einem Kühlmitteleinlass (5a) und einem Auslass (5b) für verdichtetes Kühlmittel;
einer Platte (8) zum Trennen von Hoch- und Niederdruck, die an der Oberseite der fixierten Rolle angebracht ist und den Innenraum des geschlossenen Behälters in eine Hochdruckkammer (10) und eine Niederdruckkammer (14) unterteilt, wobei die Platte zum Trennen von Hoch- und Niederdruck ein Gasableitloch (8a) aufweist;

einer umlaufenden Rolle (6) mit einer umlaufenden Hülle (W2), die drehbar in Eingriff mit der Hülle der fixierten Rolle an der Unterseite der fixierten Rolle ausgebildet ist, um zu ermöglichen, dass eine Vielzahl von Zwischenverdichtungskammern (7; 24) einen unterschiedlichen Druck aufweisen, wenn sie hintereinander durch Drehen der umlaufenden Rolle bewegt werden, und

einer Vakuum verhindernden Ventileinheit innerhalb des geschlossenen Behälters des Rollenverdichters,

dadurch gekennzeichnet, dass

zur Vermeidung eines hohen Vakuums innerhalb des geschlossenen Behälters (3) ein Zylinder (120) in vertikaler Richtung innerhalb des Körpers der fixierten Rolle (5) zwischen der Hochdruckkammer (10) und der Niederdruckkammer (14) ausgebildet ist, wobei der Zylinder mit den Zwischenverdichtungskammern (7; 24), in welchen das Kühlmittel verdichtet wird, in Verbindung steht, wobei ein Ventilelement (121), das zur Verbindung der Auslass- und der Ansaugdruckabteilungen eine Kühlmittelflussrille (121a) an seiner äußeren Umfangsfläche aufweist, gleitend in den Zylinder eingesetzt und gemäß Druckveränderungen der Zwischenverdichtungskammern (7; 24) in Abhängigkeit von dem Betriebszustand des Verdichters beweglich ist, um die Niederdruckkammer und die Hochdruckkammer jeweils miteinander zu verbinden oder gegeneinander abzuriegeln, und wobei ein elastisches Element (130) zwischen das Ventilelement (121) und das Ventilgehäuse eingesetzt ist, um das Ventilelement zu stützen und die Bewegung des Ventilelementes zu verstärken.

2. Verdichter gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Ventilgehäuse durch das Ventilelement (121) in einen Ansaugdruckraum und einen Zwischendruckraum (24) unterteilt ist, um einen Ventilabweichungsraum in vertikaler Richtung zu haben, wobei ein Gasloch auf der Seite des Ansaugdrucks an dem Ansaugdruckraum ausgebildet ist, um von dem Ventilelement geöffnet und geschlossen zu werden, um mit der Niederdruckkammer (14) in Verbindung zu stehen, wobei ein Gasloch (122) auf der Seite des Zwischendrucks an dem Zwischendruckraum ausgebildet ist, um mit der Zwischenverdichtungskammer in Verbindung zu stehen, und wobei ein Gasloch auf der Seite des Auslassdrucks an der Umfangsfläche ausgebildet ist, um von dem Ventilelement zusammen mit dem Gasloch auf der Ansaugdruckseite geöffnet und geschlossen zu werden, um mit der Hochdruckkammer (10) in Verbindung zu stehen.

3. Verdichter gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das elastische Element (130) in den Ansaugdruckraum des Ventilgehäuses eingesetzt ist.

Revendications

1. Compresseur à rouleau comprenant :

un tuyau d'aspiration (1) et un tuyau de décharge (2) qui sont chacun montés à une face latérale d'un conteneur fermé (3) rempli d'huile (15) jusqu'à un niveau adéquat ;

un rouleau fixé (5) ayant une enveloppe (W1) et une entrée d'agent réfrigérant (5a) et une sortie d'agent réfrigérant comprimé ;

une plaque (8) de séparation entre une haute pression et une basse pression qui est installée sur la face supérieure du rouleau fixé pour diviser l'intérieur du conteneur fermé en une chambre à haute pression (10) et une chambre à basse pression (14), la plaque de séparation entre une haute pression et une basse pression comprenant un trou de décharge de gaz (8a) ;

un rouleau sur orbite (6) ayant une enveloppe sur orbite (W2) en prise avec l'enveloppe du rouleau fixé de manière rotative à la face inférieure du rouleau fixé pour permettre à une pluralité de chambres de compression intermédiaires (7, ; 24) à avoir des pressions différentes quand elles sont successivement déplacées par rotation du rouleau en orbite, et

une soupape de prévention de vide à l'intérieur du conteneur fermé du compresseur à rouleau,

caractérisé en ce que

pour prévenir un grand vide à l'intérieur du conteneur fermé (3), un cylindre (120) est formé dans la direction verticale à l'intérieur du corps du rouleau fixé (5) entre la chambre à haute pression (10) et la chambre à basse pression (14), lequel cylindre communique avec les chambres de compression intermédiaires (7 ; 24) dans lesquelles l'agent réfrigérant est comprimé, un membre de soupape (121) comprenant une rainure d'écoulement d'agent réfrigérant (121 a) sur sa surface circonférentielle extérieure pour relier les compartiments de pression de décharge et de pression d'aspiration l'un à l'autre étant inséré de manière glissante dans le cylindre et étant susceptible d'être déplacé selon des variations de pression des chambres de compression intermédiaires (7 ; 24) en fonction de l'état de fonctionnement du compresseur pour respectivement relier la chambre à basse pression et la chambre à haute pression l'une à l'autre ou pour les barrer l'une contre l'autre, et un membre élastique (130) étant inséré entre le membre de soupape (121) et le boîtier de soupape pour appuyer le membre de soupape et pour renforcer le mouvement du membre de soupape.

2. Compresseur selon la revendication 1, **caractérisé en ce que** le boîtier de soupape est divisé en un espace de pression d'aspiration et un espace de pression intermédiaire (24) par le membre de soupape (121) pour avoir un espace de mouvement de soupape dans la direction verticale, dans lequel un trou de gaz du côté de pression d'aspiration est formé dans l'espace de pression d'aspiration pour être ouvert et fermé par le membre de soupape pour communiquer avec la chambre à basse pression (14), un trou de gaz du côté de pression intermédiaire (122) est formé dans l'espace de pression intermédiaire pour communiquer avec la chambre de pression intermédiaire et un trou de gaz du côté de pression de décharge est formé sur la surface circonférentielle pour être ouvert et fermé par le membre de soupape ensemble avec le trou de gaz du côté de pression d'aspiration pour communiquer avec la chambre à haute pression (10).

3. Compresseur selon la revendication 1 ou la revendication 2, **caractérisé en ce que** le membre élastique (130) est inséré dans l'espace de pression d'aspiration du boîtier de soupape.

FIG. 1

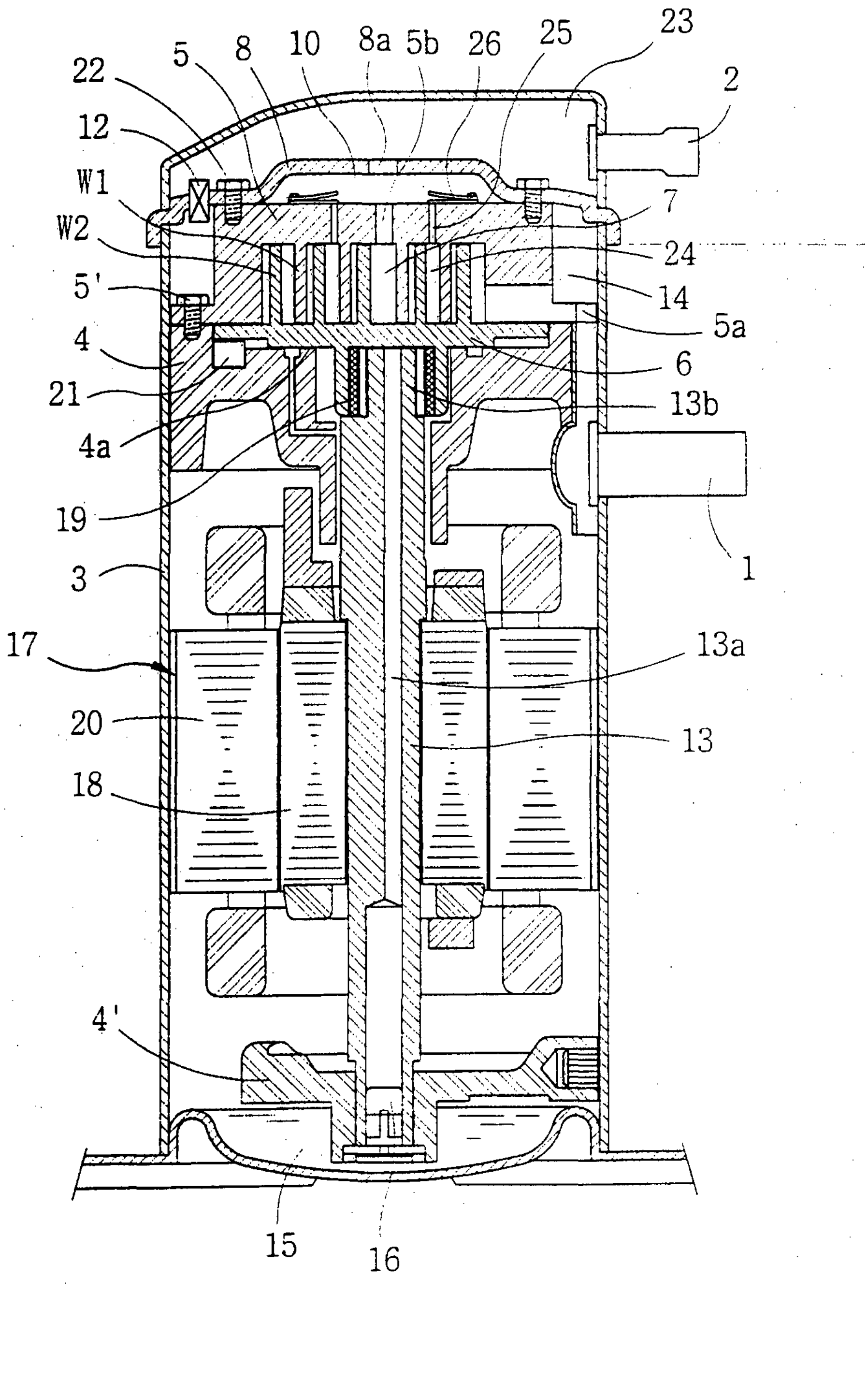

23
2
5
8
10
8a
5b
26
25
22
12
W1
W2
7
24
14
5'
5a
4
6
21
13b
4a
19
1
3
17
13a
20
13
18
4'
15
16

FIG. 2

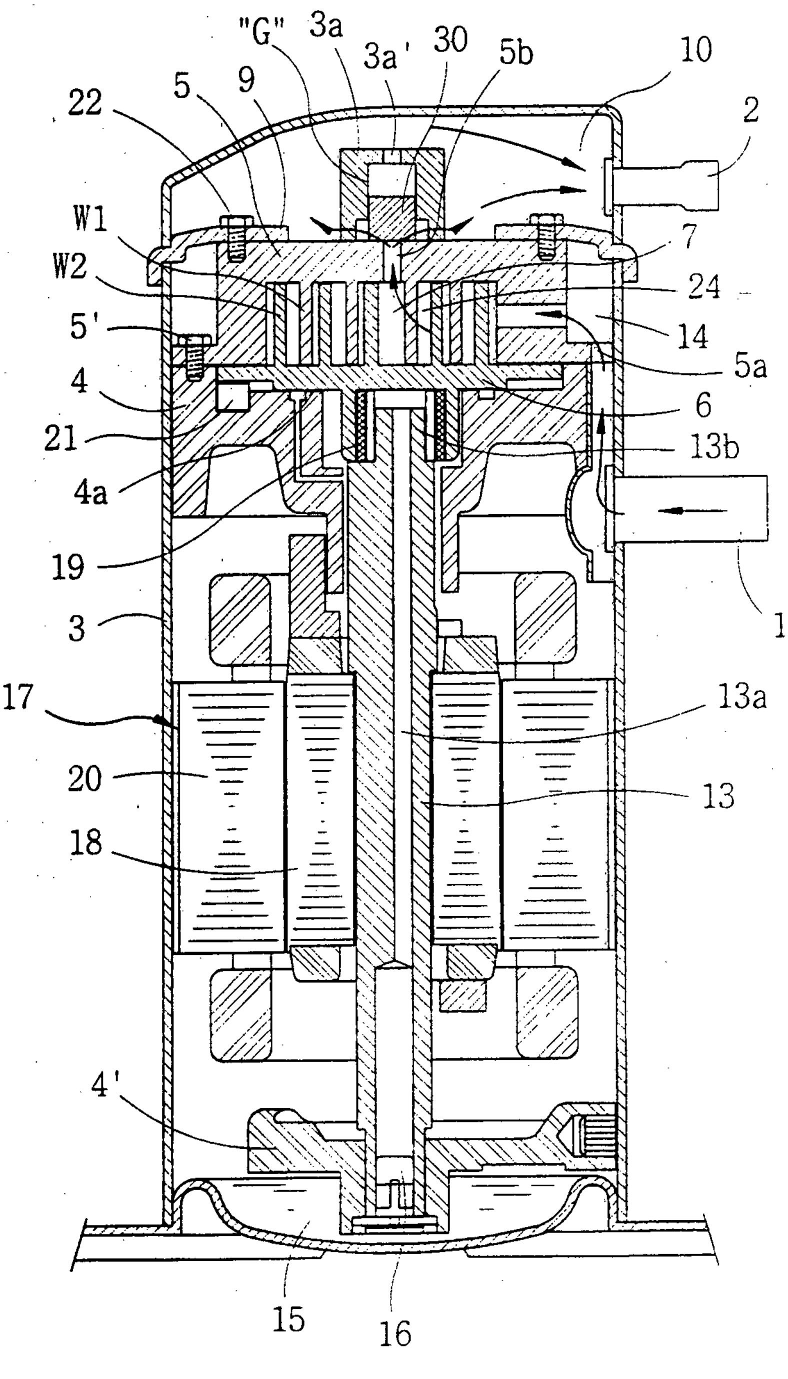

"G"
3a
3a'
30
5b
10
2
22
5
9
W1
W2
5'
4
21
4a
19
3
17
20
18
7
24
14
5a
6
13b
1
13a
13
4'
15
16

FIG. 3

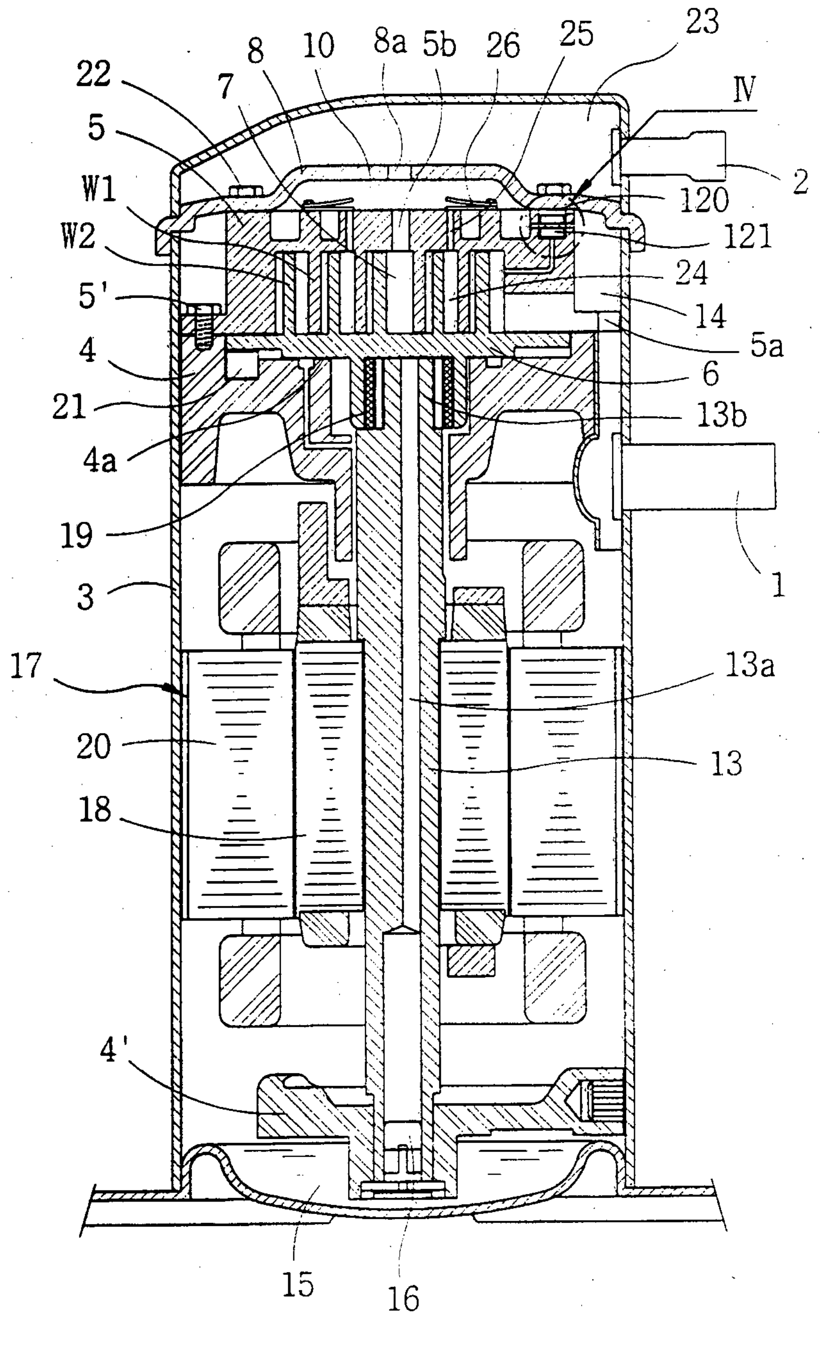

22
5
W1
W2
5'
4
21
4a
19
3
17
20
18
4'
7
8
10
8a
5b
26
25
23
IV
2
120
121
24
14
5a
6
13b
1
13a
13
15
16

FIG. 4

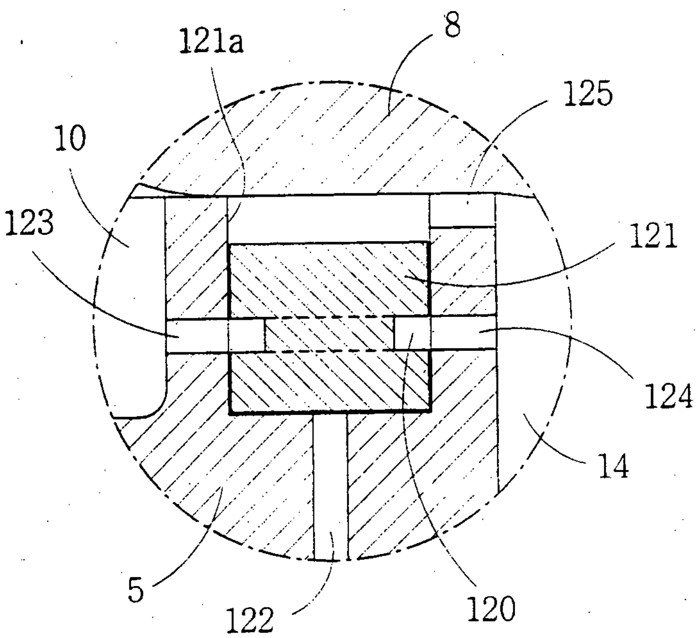


FIG. 5A

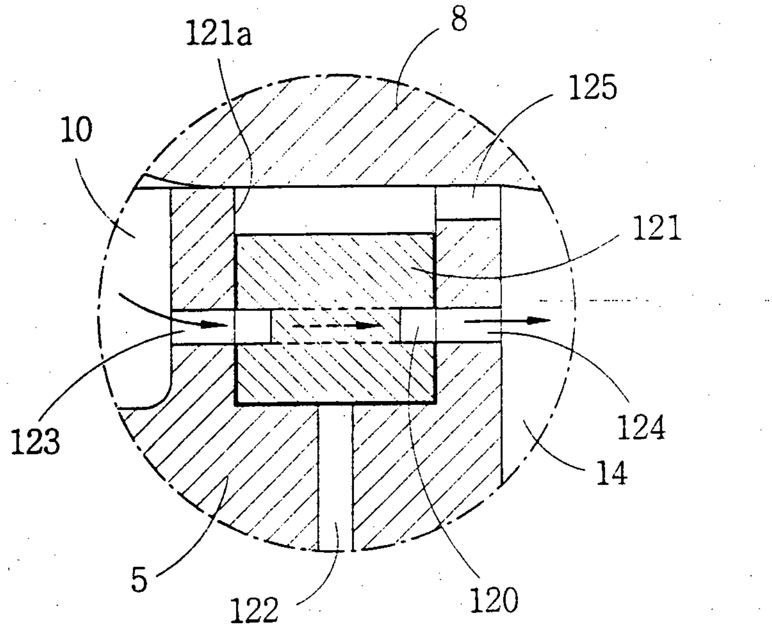

8
121a
125
10
121
123
124
14
5
122
120

FIG. 5B

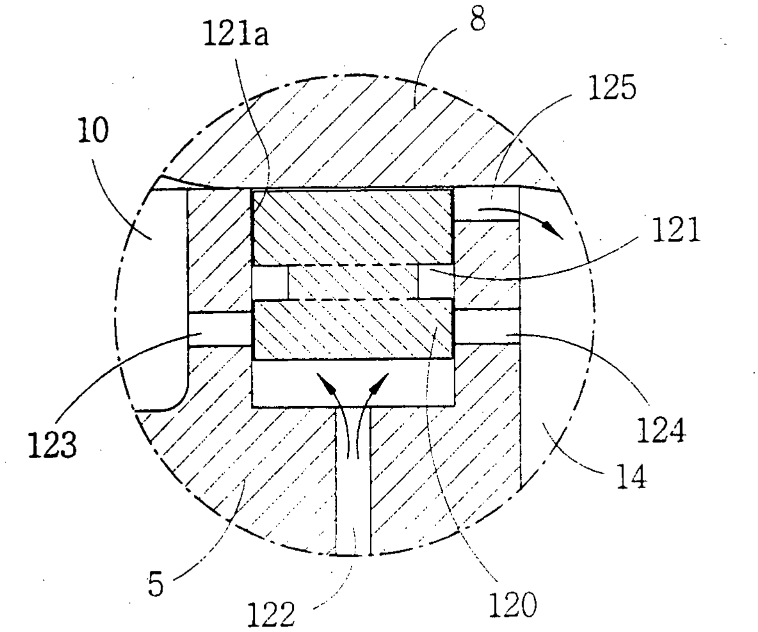

8
121a
125
10
121
123
124
14
5
122
120

FIG. 6

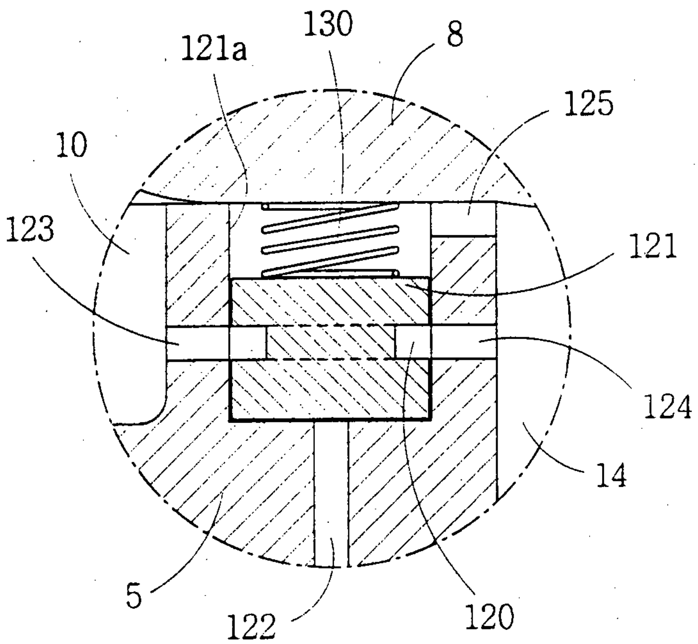


FIG. 7A

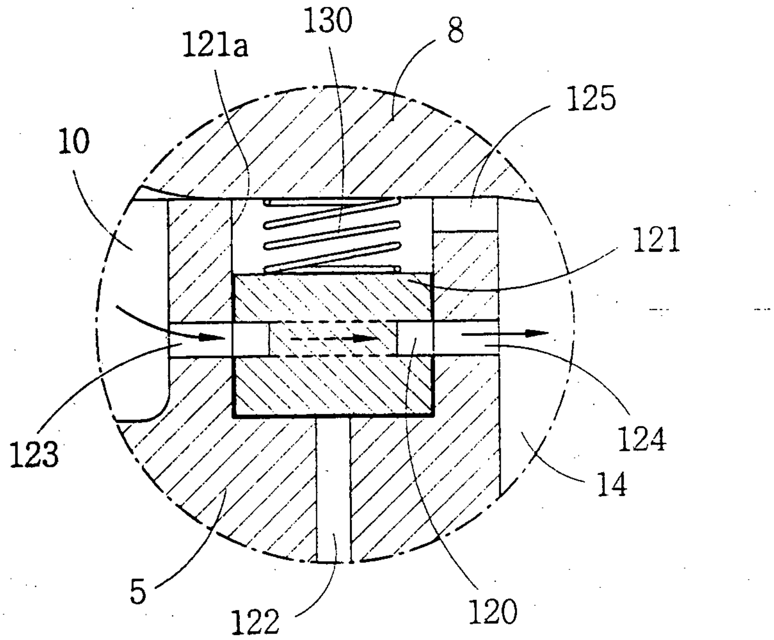

121a
130
8
125
10
121
123
124
14
5
122
120

FIG. 7B

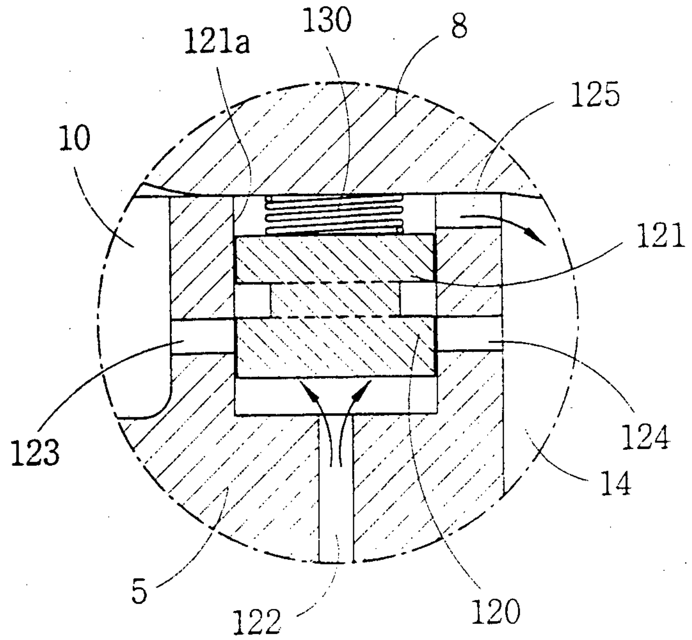
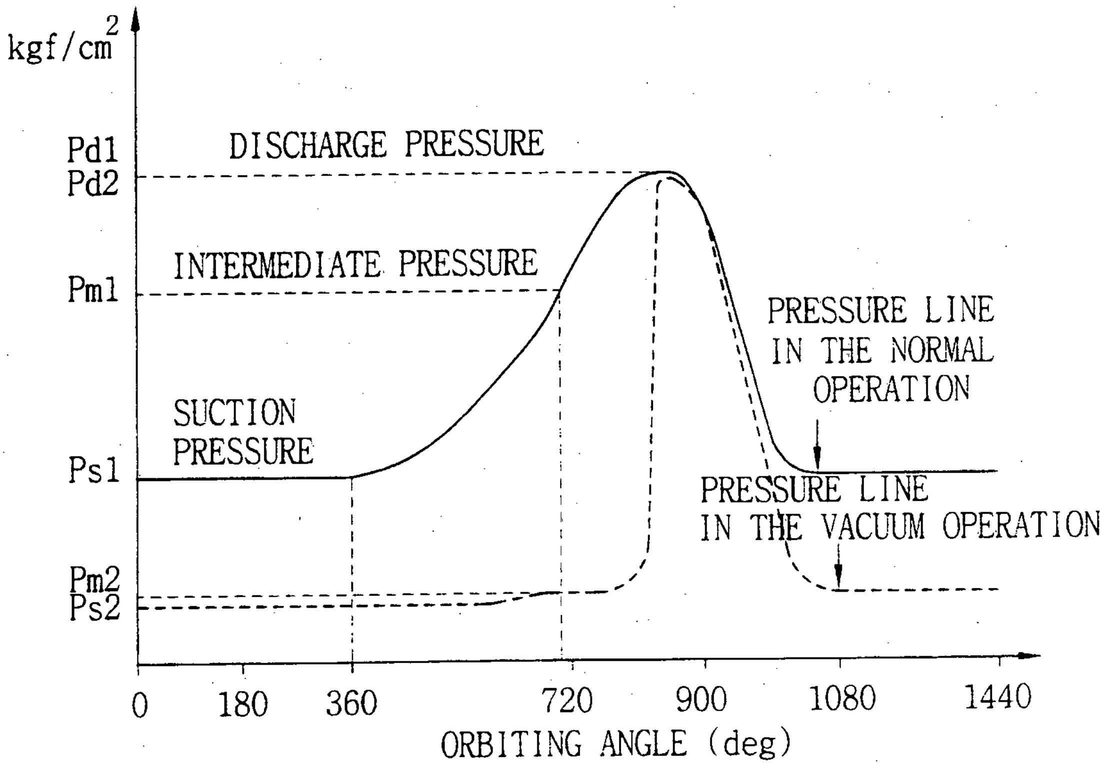

121a
130
8
125
10
121
123
124
14
5
122
120

FIG. 8


kgf/cm2
Pd1
Pd2
Pm1
Ps1
Pm2
Ps2
DISCHARGE PRESSURE
INTERMEDIATE PRESSURE
SUCTION PRESSURE
PRESSURE LINE IN THE NORMAL OPERATION
PRESSURE LINE IN THE VACUUM OPERATION
0
180
360
720
900
1080
1440
ORBITING ANGLE (deg)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5090880 A **[0036] [0037]**
- US 5169294 A **[0036] [0038]**
- US 5803716 A **[0039]**